

Trends in the Development of Project-Based E -LKPD Assisted by Google Classroom in the Utilization of Nettle Leaves as Joint Medicine to Improve Students' Science Literacy and Creativity: Bibliometric Analysis

Lalu Arju Aria Yusma^{1*}, Muntari^{1,2}, Zulkifli^{1,2}, Aris Doyan^{1,3}

¹ Master of Science Education Study Program, University of Mataram, Mataram, 83125, Indonesia

² Chemistry Education Study Program, FKIP, University of Mataram, Mataram, 83125, Indonesia

² Biology Education Study Program, FKIP, University of Mataram, Mataram, 83125, Indonesia

³ Physics Education Study Program, FKIP, University of Mataram, Mataram, 83125, Indonesia

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Corresponding Author:

Lalu Arju Aria

Yusmalaluarjuay@gmail.com

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Abstract: This study aims to analyze the trend of scientific publications of research related to the development of E-LKPD (Electronic Student Worksheets) based on projects assisted by *platforms*. *Google Classroom* with a focus on the use of nettle leaves as a joint medicine in the context of scientific literacy and student creativity. The bibliometric method was used with the help of *Publish or Perish*, Dimensions.ai, and VOSviewer. The results show a sharp increase in the number of publications since 2020 to peak in 2023, along with increasing interest in project-based learning and digitalization of teaching materials. Keyword visualization reveals the relationship between the topics of "literacy", "student", "teacher", "innovation", and "STEM" as key elements. These findings indicate that the development of contextual and technology-based E-LKPD has a significant contribution to scientific literacy and student creativity.

Keywords: Bibliometrics, E -LKPD; Project-Based Learning; *Google Classroom*; Nettle Leaves; Science Literacy; Student Creativity

Introduction

The development of digital education technology has driven innovation in the development of learning media, one of which is project-based *E -LKPD* (Electronic Student Worksheet). This media allows students to be actively involved in the learning process, increase motivation, and facilitate more interactive learning (Smith *et al.*, 2022). The use of *Google Classroom* in the development of this media supports independent, collaborative, and real-life experience-based learning processes (Salamah, 2020). One relevant approach is the use of local medicinal plants, such as nettle leaves, as a theme for a scientific project integrated with environmental and health literacy.

Nettle leaves (*Urtica dioica L.*) are known to have various properties, including as a traditional medicine to overcome joint problems. The use of local natural materials in science learning can provide a more relevant context for students, as well as increase their awareness of the potential of natural resources around them (Wang *et al.*, 2021). This study conducted a bibliometric analysis to map global research trends and directions on the topic.

Method

This study uses bibliometric analysis to explore scientific publication trends in the 2016-2025 period. Bibliometric analysis is effective in summarizing extensive bibliographic data and revealing hidden patterns by adding stages to the literature review

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method, thus assisting the research process and identifying knowledge gaps and research trends (Shuang *et al.*, 2023).

The data source in this study comes from *Google Scholar*. There are 3 applications used, namely *Publish or Perish*, *Dimensions.ai*, and *VOSviewer*. Data from the *Google Scholar database* is taken through the *Publish or Perish* application. Then analyzed using *VOSviewer*. *VOSviewer* will map the most frequently used keyword data, while *Dimensions.ai* is used to analyze general data, such as publication trends by year, type of publication, most popular journals, and number of citations by document. The main keywords used, both in *Dimensions.ai* and *Publish or Perish* are "E-LKPD", "Google Classroom", "Project-Based Learning", "Urtica dioica", "Scientific literacy", "Creativity", and "Digital learning" in the period 2016-2025.

Result and Discussion

Figure 1, a graph of the number of publications from 2016 to 2025, shows a significant trend in research development in the field of project-based E-LKPD development with the help of *Google Classroom*, especially in the use of nettle leaves as a joint medicine

to improve science literacy and student creativity. In the early period (2016-2019), the number of publications was still very minimal, even no publications were recorded, indicating that this topic was still in the early exploration stage or received little attention at that time. However, starting in 2020, there was a significant increase in the number of publications, peaking in 2023 with a total of 17 publications. This increase reflects the increasing interest and academic attention to the integration of digital learning technologies, such as *Google Classroom*, in the development of innovative project-based teaching materials and the use of local natural resources, namely nettle leaves, as relevant and contextual learning media. The decrease in the number of publications in 2024 and 2025, which amounted to 14 and 3 publications respectively, can be interpreted as a transition phase of research from the development stage to a more in-depth implementation and evaluation stage. Overall, these data illustrate the dynamics and progressive development of research in an effort to improve scientific literacy and student creativity through a project-based learning approach supported by digital technology and local natural resources.

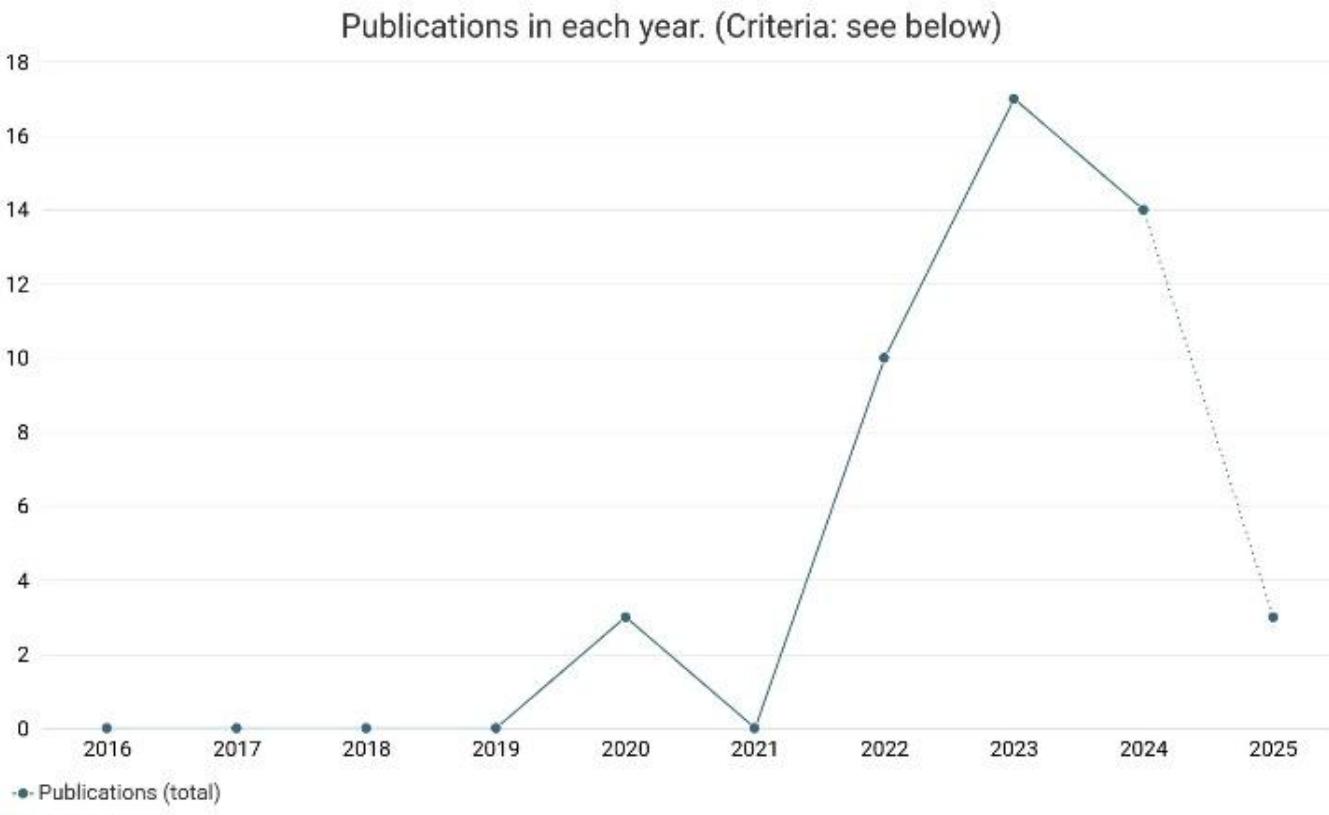


Figure 1. Research Trends 2019- 2025

Table 1. Type of Publication

Publication Type	Number of Publications	Percentage (%)
Scientific Journal	31	62
Articles		
Seminar/ Conference Proceedings	8	16
Chapter in a book (Book Chapter)	6	12
Institutional Research Report	3	6
Preprint/Institutional Repository	2	4
Total	50	100

Table 1 shows the distribution of publication types discussing the development of project-based E-LKPD assisted by *Google Classroom* in the use of nettle leaves as a joint medicine to improve scientific literacy and student creativity during the period 2016-2025. The majority of publications (62%) are in the form of scientific articles, indicating that this topic has received significant attention from academics and researchers. Zeng *et al.* (2017) explained that scientific articles are a very effective means of disseminating the latest research findings to the wider scientific community. Publications in the form of seminar proceedings contributed 16%, indicating that this topic is also widely presented in scientific forums, both nationally and internationally. Meanwhile, chapters in books contributed 12%, indicating the integration of this study in the

compilation of innovative teaching materials and pedagogy. Institutional research reports contributed 6%, generally originating from learning media development projects by universities or educational institutions. Finally, preprints or institutional repositories contributed 4%, indicating the existence of early publications or manuscripts that have not gone through the *peer-review process* but still contribute important information. Overall, these data reflect that the topic of developing project-based E-LKPD assisted by *Google Classroom* in utilizing nettle leaves as a contextual learning resource has received widespread attention and has been published through various scientific channels.

Table 2 presents the 10 journals with the highest number of publications that publish research on the development of project-based E-LKPD assisted by *Google Classroom* in the use of nettle leaves as a joint medicine to improve science literacy and student creativity during the period 2016-2025, complete with the number of publications, total citations, and average citations per article. The *Journal of Science Education and Technology* is ranked first with 7 articles and a total of 182 citations, indicating the dominant position of this journal in the development of project-based learning technology. This journal focuses on the integration of digital technology in science education, which is in line with the use of *Google Classroom* and E-LKPD (Sobri *et al.*, 2023; Rohmah, 2022; Ardiansah & Zulfiani, 2023; Hidayat & Aripin, 2023)

Table 2. 10 Most Popular Journals 2016-2025

Journal Name	Number of Publications	Quote	Quotes (Average)
Journal of Science Education and Technology	7	182	26
Indonesian Journal of Biology Education	6	114	19
International Journal of Instruction	5	120	24
Jurnal Pendidikan IPA Indonesia (JPII)	5	110	22
Education and Information Technologies	4	124	31
Jurnal Inovasi Pendidikan IPA	4	72	18
International Journal of STEM Education	3	87	29
Jurnal Pendidikan Biologi Indonesia (JPBI)	3	51	17
Current Educational Review	2	70	35
Journal of Ethnopharmacology	2	84	42

Followed by national journals such as *the Indonesian Journal of Biology Education* and the *Indonesian Journal of Science Education (JPII)* which show the active contribution of Indonesian researchers in developing contextual teaching materials based on local natural resources such as nettle leaves. The fairly high average citation (19-22 citations per article) indicates that the published research has a significant influence. International journals such as *Education and Information Technologies* and *the International Journal of STEM Education* show the global relevance of this research.

Education and Information Technologies recorded the highest total citations (124 citations from 4 articles), strengthening the important position of digital learning technology research in a global context.

Meanwhile, *the Journal of Ethnopharmacology* recorded the highest average citation per article (42 citations), indicating that scientific studies on the efficacy of nettle leaves (Widiyawati *et al.*, 2023; Setyorini *et al.*, 2023; Purwanda, 2024; Chasanah *et al.*, 2023; Putri *et al.*, 2023; Juliantari, 2023; Musthafa *et al.*, 2023) are an important foundation in the development of this

research from a biological and health perspective. In general, these data show that interdisciplinary research that combines science, technology, education, and

ethnobotany has received widespread attention both nationally and internationally and has shown a fairly high impact in the academic community.

Table 3. Number of Citations Based on Documents

Number of Quotes	Citation/ year	Publication Year	Writer	Title
2524	252.4	2016	Kokotsaki, D., Menzies, V., & Wiggins, A	Project-based Learning: A Review of The Literature
643	107.17	2020	Fuadi, H., Robbia, AZ, Jamaluddin, J., & Jufri, A. W	Analisis Faktor Penyebab Rendahnya Kemampuan Literasi Sains Peserta Didik
332	66.4	2021	Puspita, V & Dewi, I. P	Efektifitas E-LKPD Berbasis Pendekatan Investigasi Terhadap Kemampuan Berpikir Kritis Siswa Sekolah Dasar
313	31.3	2016	Abdurrozak, R., Jayadinata, AK, & Isrok'atun, I	Pengaruh Model Problem Based Learning Terhadap Kemampuan Berpikir Kreatif Siswa
307	61.4	2021	Suryaningsih, S & Nurlita, R	Pentingnya Lembar Kerja Peserta Didik Elektronik (E-LKPD) Inovatif dalam Proses Pembelajaran Abad 21
182	36.4	2021	Zahroh, D. A & Yuliani, Y	Pengembangan E-LKPD Berbasis Literasi Sains untuk Melatihkan Keterampilan BerpikirKritis Peserta Didik pada Materi Pertumbuhan dan Perkembangan
174	29	2020	Dhouibi, R., Affes, H., Salem, MB, Hammami, S., Sahnoun, Z., Zeghal, K. M., & Ksouda K.	Screening of Pharmacological Uses of <i>Urtica dioica</i> and Other Benefits
168	42	2022	Bhusal, K.K., <i>et al.</i>	Nutritional and Pharmacological Importance of Stinging Nettle (<i>Urtica dioica</i> L.): A Review
156	26	2020	Grauso, L., Falco, B.D., Lanzotti, V., & Motti, R	Stinging Nettle, <i>Urtica dioica</i> L.: Botanical, Phytochemical and Pharmacological Overview
115	28.75	2022	Taheri, Y., <i>et al.</i>	<i>Urtica dioica</i> -Derived Phytochemicals for Pharmacological and Therapeutic Applications

Table 3 shows the most cited articles in this study, reflecting topics that have a high impact and are considered significant by the scientific community. Kokotsaki *et al.*'s (2016) article entitled " *Project-based Learning: A Review of The Literature* " is the most cited article with a total of 2524 citations and an average annual citation of 252.4. Meanwhile, Taheri *et al.*'s (2022) article entitled " *Urtica dioica-Derived Phytochemicals for Pharmacological and Therapeutic Applications* " has an average annual citation of 28.75. According to Hallinger & Chatpinyakoop (2019), highly cited articles tend to be the basis for future research

Table 4 shows the most frequently occurring keywords in the research on the development of project-based E-LKPD assisted by *Google Classroom* in the use of nettle leaves as a joint medicine to improve scientific literacy and student creativity. Zawacki-Richter *et al.* (2019) explained that these keywords indicate the direction of the research, illustrating the focus in understanding the effectiveness of the development of learning media. From the table, it can be seen that the keywords "Student" (34 times), "Learning" (31 times), and "Project" (29 times) occupy the top positions. This confirms that the main focus of the research is on the

subject of education, the learning process, and *the project-based learning approach*. Keywords such as "Teacher", "Literacy", and "Curriculum" indicate the importance of the role of teachers, the goals of scientific literacy, and the relationship to the Education curriculum. Meanwhile, the terms "Technology", "Google Classroom", and "Innovation" describe the integration of digital technology in learning. Interestingly, the keywords "Ethnopharmacology" and "*Urtica dioica*" appear although with lower frequency, but show strong relevance to the local context and scientific studies that are the core of the learning content in E-LKPD. Overall, this keyword trend illustrates the direction of research that integrates pedagogical approaches, technology, and the use of local wisdom to improve students' scientific literacy and creativity.

Table 4. Keyword Trends

Keywords	Frequency of Occurrence
Student	34
Learning	31
Project	29
Teacher	27
literacy	25
	72

Curriculum	22
Innovation	20
Technology	19
Google Classroom	18
Creativity	17
Science	17
Implementation	15
Evaluation	14
Ethnopharmacology	11
Urtica dioica	9

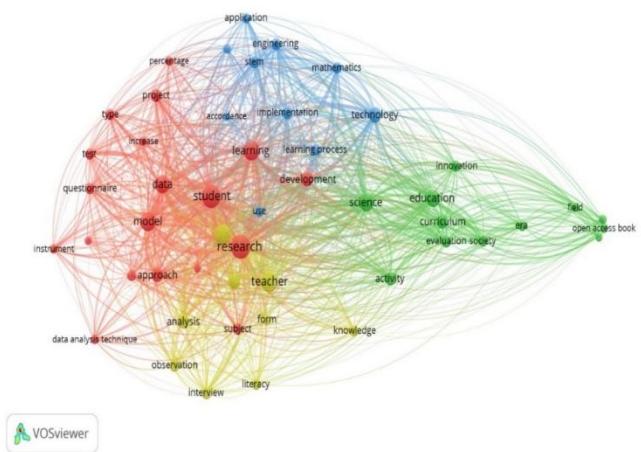


Figure 2. Network Visualization

This data analysis visualization using VOSviewer shows the network of relationships between the main keywords that often appear in research related to the development of project-based E-LKPD supported by *Google Classroom*, especially in the use of nettle leaves as a joint medicine to improve science literacy and student creativity. This diagram is divided into several color groups that represent clusters of closely related concepts. The red cluster highlights terms such as *student*, *learning*, *data*, and *project*, which indicate a focus on the learning process and data collection in research. The yellow cluster groups keywords such as *teacher*, *research*, *literacy*, and *interview*, which indicate the important role of teachers and qualitative research methods in the development of teaching materials and the evaluation of student literacy. The green cluster contains terms such as *education*, *science*, *curriculum*, and *innovation*, which describe the broader educational context and innovation in the curriculum that supports improving science literacy. Meanwhile, the blue cluster displays keywords such as *technology*, *implementation*, *STEM*, and *engineering*, which emphasize the integration of technology and STEM approaches in project-based learning. The complex and interconnected relationships between these clusters indicate that the development of project-based E-LKPD with *Google Classroom* involves various multidisciplinary aspects, ranging from technology, pedagogy, to curriculum innovation, which

together contribute to improving students' scientific literacy and creativity effectively.

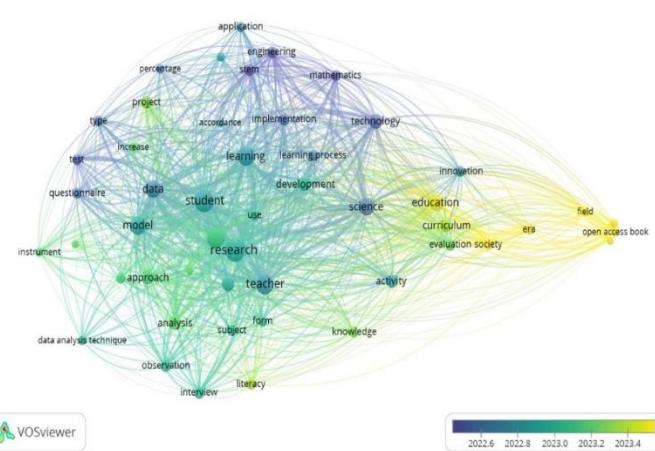


Figure 3. Overly Visualization

This data analysis visualization using VOSviewer displays a network of keywords that frequently appear in research related to the development of project-based E-LKPD with the help of *Google Classroom*, especially in the context of utilizing nettle leaves as a joint medicine to improve science literacy and student creativity. This diagram uses a gradient color scheme that represents the time of keyword appearance, starting from purple and blue indicating terms that appear more in 2022, to green and yellow indicating keywords that are more dominant in 2023. The node size indicates the frequency of the keyword's appearance in the publication. Keywords such as *research*, *student*, *learning*, and *teacher* have large node sizes, indicating a high frequency of appearance and are the main focus of the research. The purple and blue keyword clusters, such as *technology*, *implementation*, *STEM*, and *mathematics*, indicate that aspects of technology and STEM approaches have been widely discussed since 2022. Meanwhile, the green and yellow clusters that include keywords such as *education*, *curriculum*, *innovation*, and *evaluation society* indicate a growing research trend in 2023, highlighting curriculum innovation and evaluation in the context of education. The complex relationships between these keywords indicate that research in this area continues to develop dynamically, with the integration of technology, pedagogy, and curriculum innovation being strengthened over time to support the improvement of students' scientific literacy and creativity.

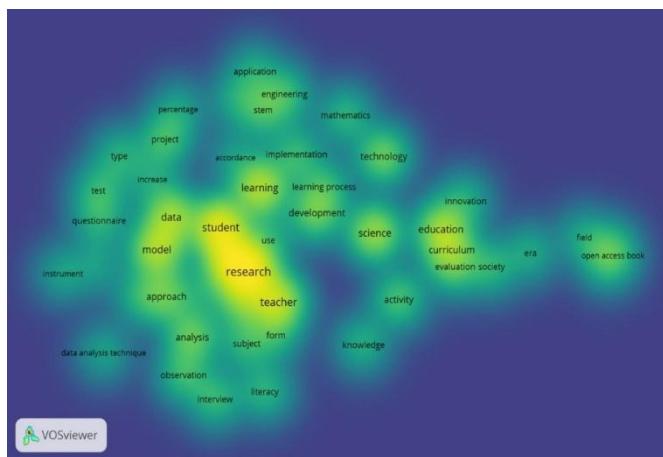


Figure 4. Density Visualization

This heatmap visualization produced by VOSviewer shows the distribution of keyword frequency in research related to the development of project-based E-LKPD with the help of Google Classroom, especially in the use of nettle leaves as a joint medicine to improve science literacy and student creativity. The dominant yellow color in the middle of the heatmap shows the keywords with the highest frequency of occurrence, such as *research*, *student*, *teacher*, and *learning*, indicating that these aspects are the main focus of the research. The green and blue areas indicate keywords with lower frequency of occurrence, such as *technology*, *science*, *education*, and *innovation*, which also have important roles but with slightly lower intensity. This heatmap illustrates the close relationship between various main concepts in educational research, ranging from the learning process, the role of teachers and students, to the integration of technology and curriculum innovation. Thus, this visualization confirms that research in this field is multidimensional and interconnected, which together support efforts to improve science literacy and student creativity through project-based learning approaches and digital technology.

Conclusion

Bibliometric analysis offers an in-depth understanding of the evolution of the research field over time. The results of the analysis show an increasing trend in the development of project-based E-LKPD with the help of Google Classroom, especially those utilizing nettle leaves as a joint medicine to improve students' scientific literacy and creativity. Since 2020, publications on this study have soared, indicating a high academic interest in the integration of digital technology, project-based learning, and the use of local natural resources in education. Keywords such as "student", "learning", "project", and "technology" emphasize the focus on

active learning, innovation, and scientific literacy. Overall, the development of technology-based and contextual E-LKPD has been shown to contribute significantly to improving students' scientific literacy and creativity.

Author Contributions

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Conflicts of Interest

The authors declare no conflict of interest

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